

# Line-frequency converter transforms 50 Hz into 60 Hz

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Low-power equipment driven from the 60-hertz power line can usually be expected also to work properly at 50 Hz—that is, except for electric clocks and other time-keeping devices, to which many a traveler outside North America will attest. For such devices, a circuit that provides a multiplication ratio of 6:5 for generating a 60-Hz output from a 50-Hz input is required. Such a low-cost, low-power circuit is shown here.

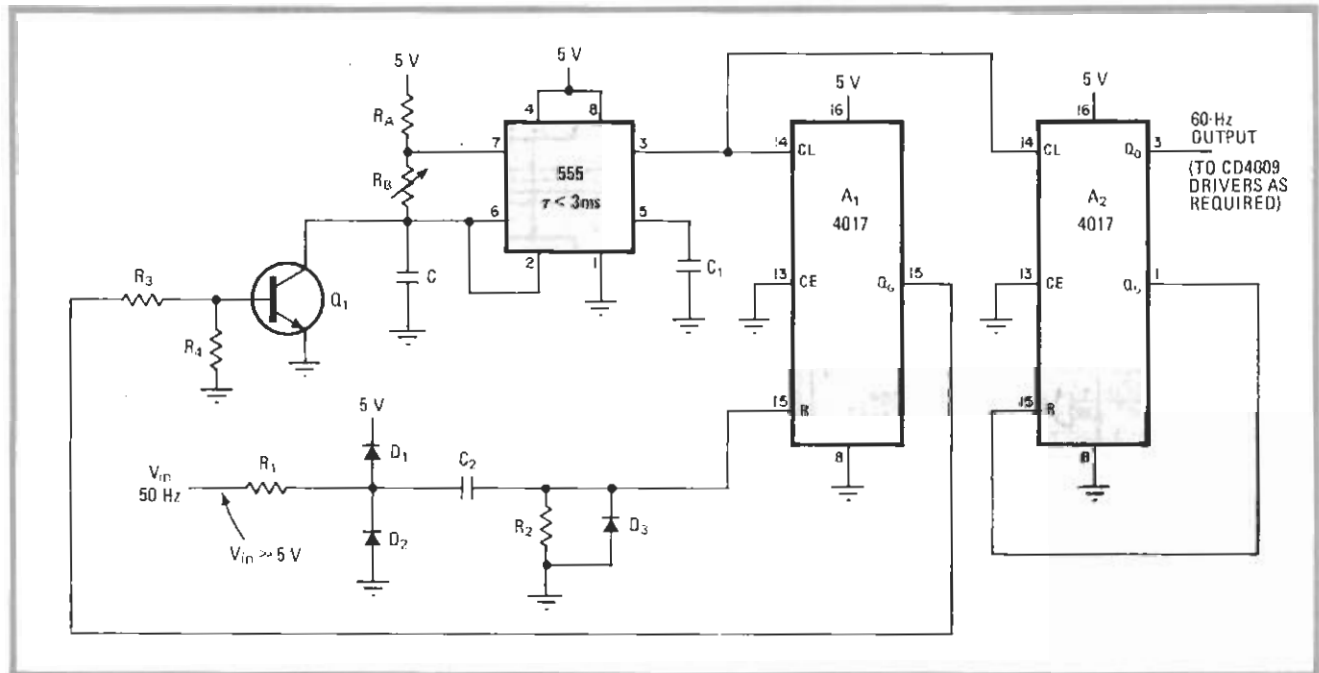
The 555 timer, operating as an astable multivibrator at 300 Hz, provides the 4017 counter, A<sub>1</sub>, with six

count-pulses for every reset pulse from the 50-Hz line. The timer's period of oscillation—about 3 milliseconds—is not critical as long as six of its cycles are completed in less than 20 ms, the period of the 50-Hz line frequency.

On the sixth pulse, Q<sub>6</sub> of A<sub>1</sub> moves high and disables the timer through transistor Q<sub>1</sub> by shorting capacitor C. Thus, independent of the period set for the 555, its average frequency is  $50 \times 6 = 300$  Hz. At the positive zero-crossing of the line voltage that occurs shortly after the sixth pulse, A<sub>1</sub> is reset through R<sub>1</sub>—R<sub>2</sub>, C<sub>2</sub>, and D<sub>1</sub>—D<sub>2</sub>, and the process repeats.

Counter A<sub>2</sub> provides a divide-by-five function at 300 Hz, thereby generating an output frequency of 60 Hz. C-MOS drivers or transistors can provide increased current capability as required. □

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**On time.** Three-chip multiplier converts 50-Hz power-line frequency into 60 Hz for devices used in the U. S. A<sub>1</sub> generates six pulses for every 50-Hz cycle, forcing 555 timer to generate average frequency of 300 Hz. A<sub>2</sub> provides divide-by-five function on 555 waveform.